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Pt-based catalysts for diesel exhaust oxidation: support effect and bimetallic elements

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The emission control of harmful gases from diesel-fuelled automobiles is currently a global challenge with environmental and public health implications. Tighter emission regulations is driving the automotive industry to develop highly efficiency catalytic converter devices, where the diesel oxidation catalyst (DOC) has the crucial role of decreasing the pollution levels through the oxidation reaction of nitrogen oxides (NO_x), carbon monoxide (CO), unburned hydrocarbons (HC, e.g. propene) and sulfur oxides (SO_x) [1].

Scarce and precious metals, especially platinum (Pt), or platinum combined with palladium (PtPd) as bimetallic elements represent the state of the art DOCs. Cost reduction, in eg. platinum, and improving the catalyst lifetime are two main goals of the current technology. In the oxygen-rich environment of a diesel engine exhaust at high temperatures, the active nanoparticles that are deposited typically in a high surface area support (e.g. γ -Al₂O₃, SiO₂) are prone to sintering by particle migration or Ostwald ripening mechanism [2], leading to a loss of metallic surface area and subsequent efficiency.

In this work, the activity for HC oxidation and stability of platinum catalysts prepared by incipient wetness impregnation method was studied regarding the support effect (MgAl₂O₄, SiO₂ and γ -Al₂O₃) and addition of a second metal element (Ni, Fe, W, Pd). The Pt/MgAl₂O₄ catalyst presented a remarkable stability at extreme conditions (750 °C, 10% O₂), allied to better activity after a high temperature reduction pre-treatment (800 °C, 5% H₂). On the other hand the PtFe, especially for lower metal loadings of Fe (ca. 0.1 wt.%) exhibits a promising behavior as a replacement of the commercial PtPd.

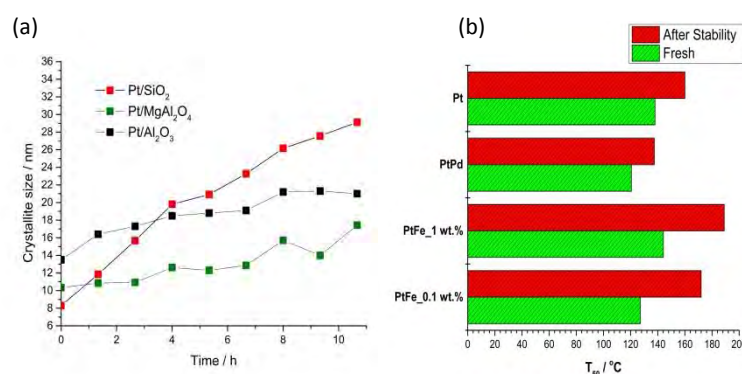


Figure 1 – (a) Crystallite size of Pt on different supports from *in situ* XRD measurements; (b) Temperature of half conversion (T₅₀) for Pt/SiO₂ and PtX/SiO₂ (X=Fe and Pd).

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